



# **Buffelgrass Management: Data Requirements and Modeling Tools for Decision Making**

RISE Symposium  
Saturday, 13 October 2012

Lindy Brigham, PhD  
Executive Director  
Southern Arizona Buffelgrass  
Coordination Center  
(SABCC)

# Talk Outline

- The Culprit
- The Issues
- The Data Needed for the Tools
- The Opportunities for YOU

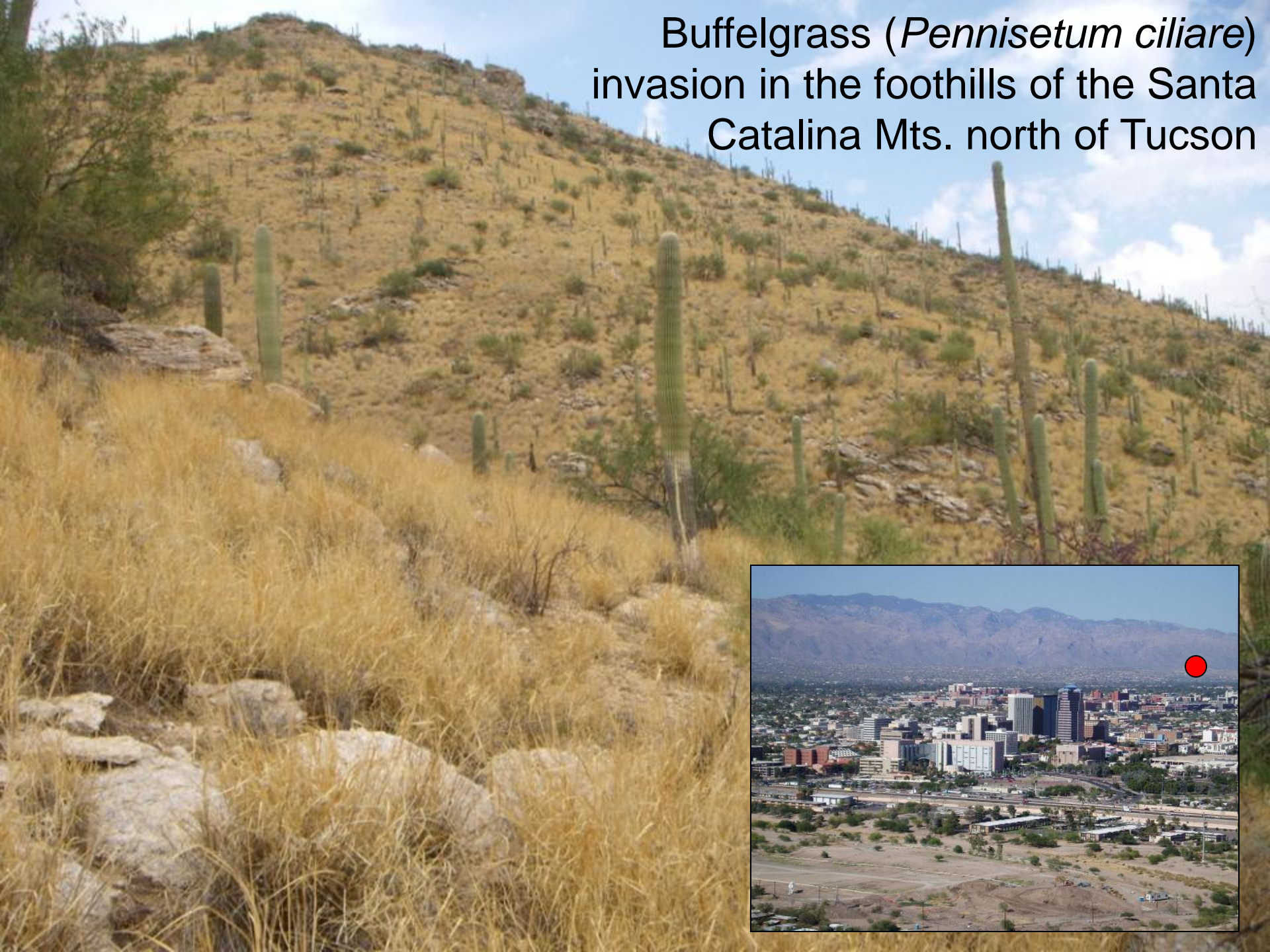
[www.buffelgrass.org](http://www.buffelgrass.org)

# Buffelgrass - *Pennisetum ciliare*

- Perennial C4 bunchgrass from Africa/S. Asia
- Individuals can live 20 yrs
- Swollen stem bases allow it to store carbs & survive grazing, drought & fire
- Hairy ligules
- Rough rachis
- Green only during rains, making spraying difficult to manage
- Apomictic & rhizomatous, seeds viable for up to 4 yrs
- Introduced into Arizona in the 1950's for erosion control



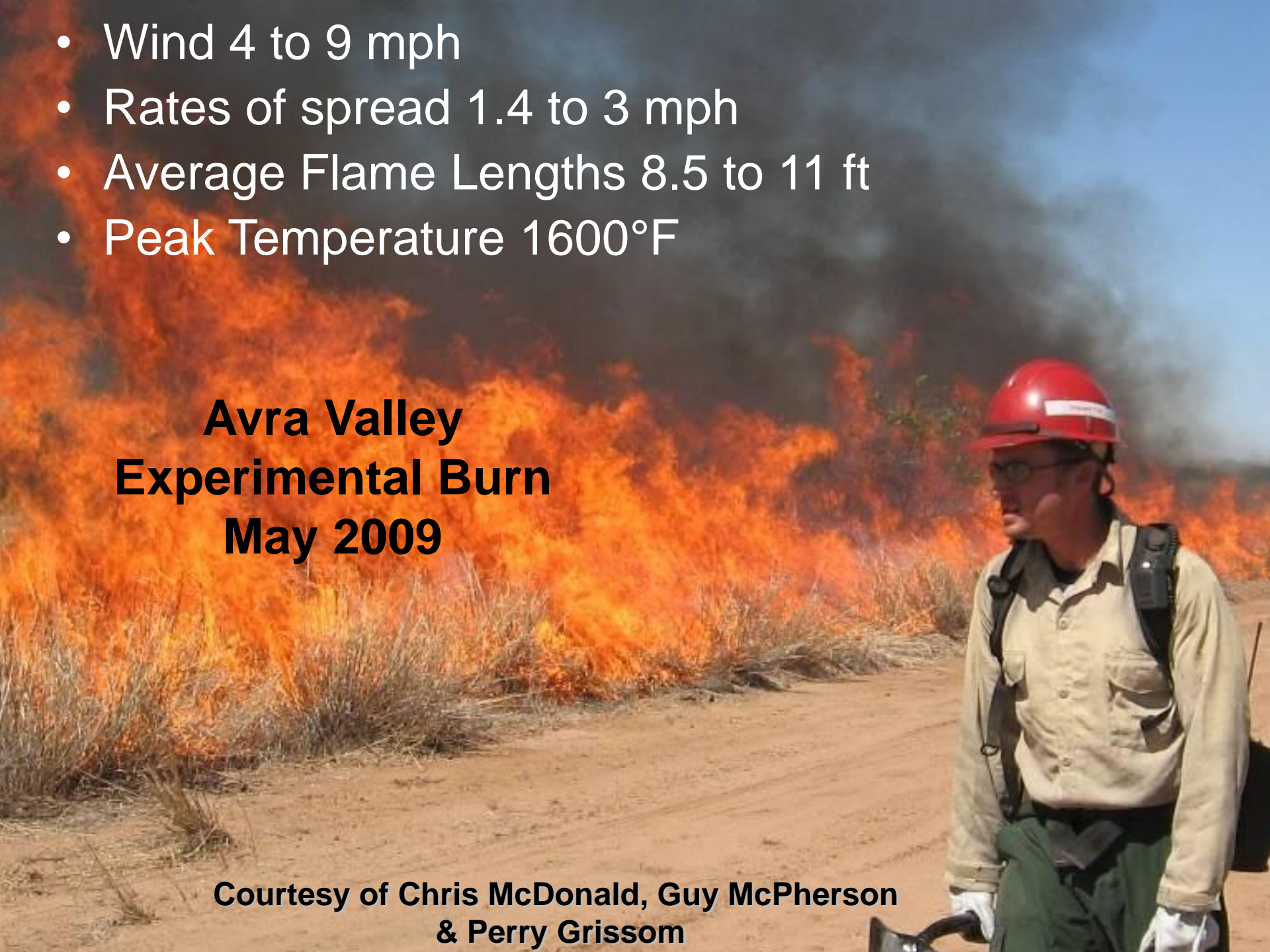
Buffelgrass (*Pennisetum ciliare*)  
invasion in the foothills of the Santa  
Catalina Mts. north of Tucson



- Wind 4 to 9 mph
- Rates of spread 1.4 to 3 mph
- Average Flame Lengths 8.5 to 11 ft
- Peak Temperature 1600°F

**Avra Valley  
Experimental Burn  
May 2009**

**Courtesy of Chris McDonald, Guy McPherson  
& Perry Grissom**



# Mitigating the effects of Buffelgrass

- What are our priorities and why?
- Where is it?
- How much of it is there?
- How great are the differences in terrain and other conditions?
- What management strategies work in different areas under different conditions?
- Are our efforts working?

# Tools and Technology Development

- Risk Assessment
- Regional Buffelgrass Mapping
- Decision Support Systems
- New/Improved Technologies

# Risk Assessment

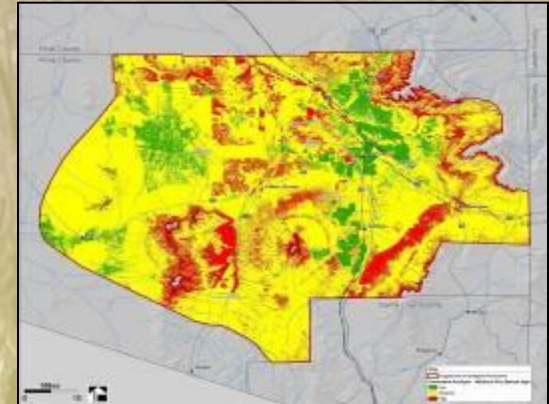
- What are our values – what do we want to protect?
- Where are these resources on the landscape?
- What are the influencing factors?
- Where are the highest risks to valued resources?
- How do we prioritize mitigation efforts?

# Vulnerability, Risk, & Priority Assessment Associated with Buffelgrass Invasion in the Tucson Basin

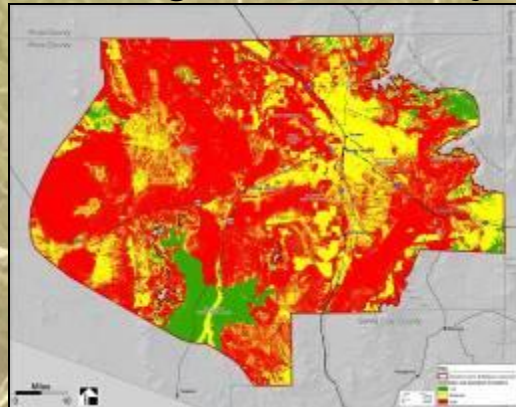
**Landcover**



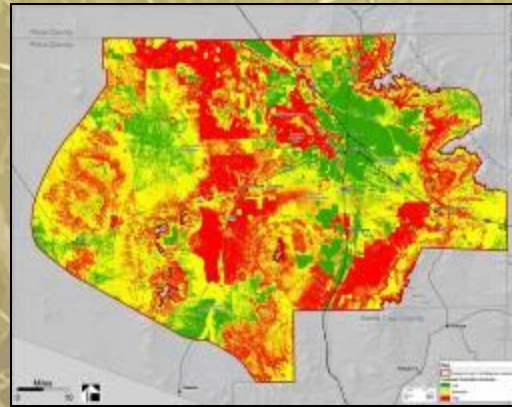
**Ecological impacts**



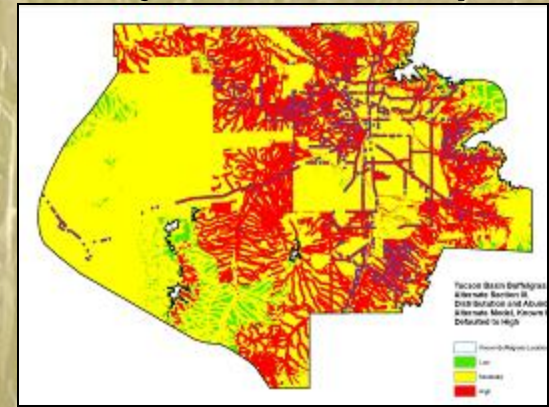
**Buffelgrass Suitability**



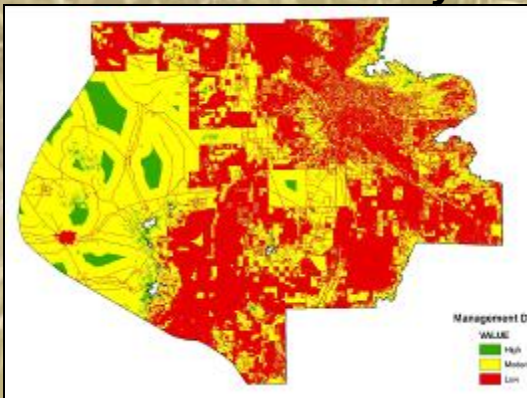
**Cumulative Risk**



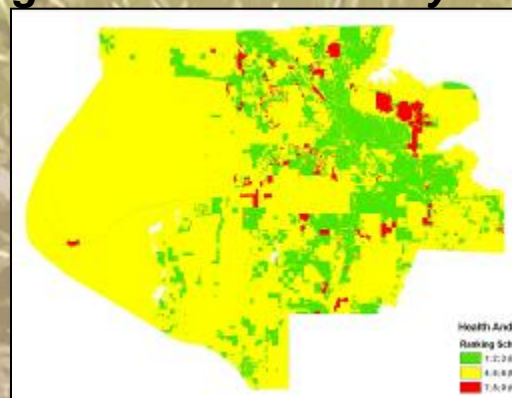
**Pathways for Further Spread**



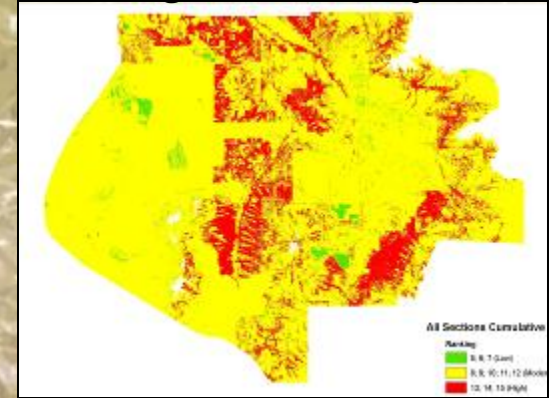
**Treatment Difficulty**



**Highest Health & Safety Risk**

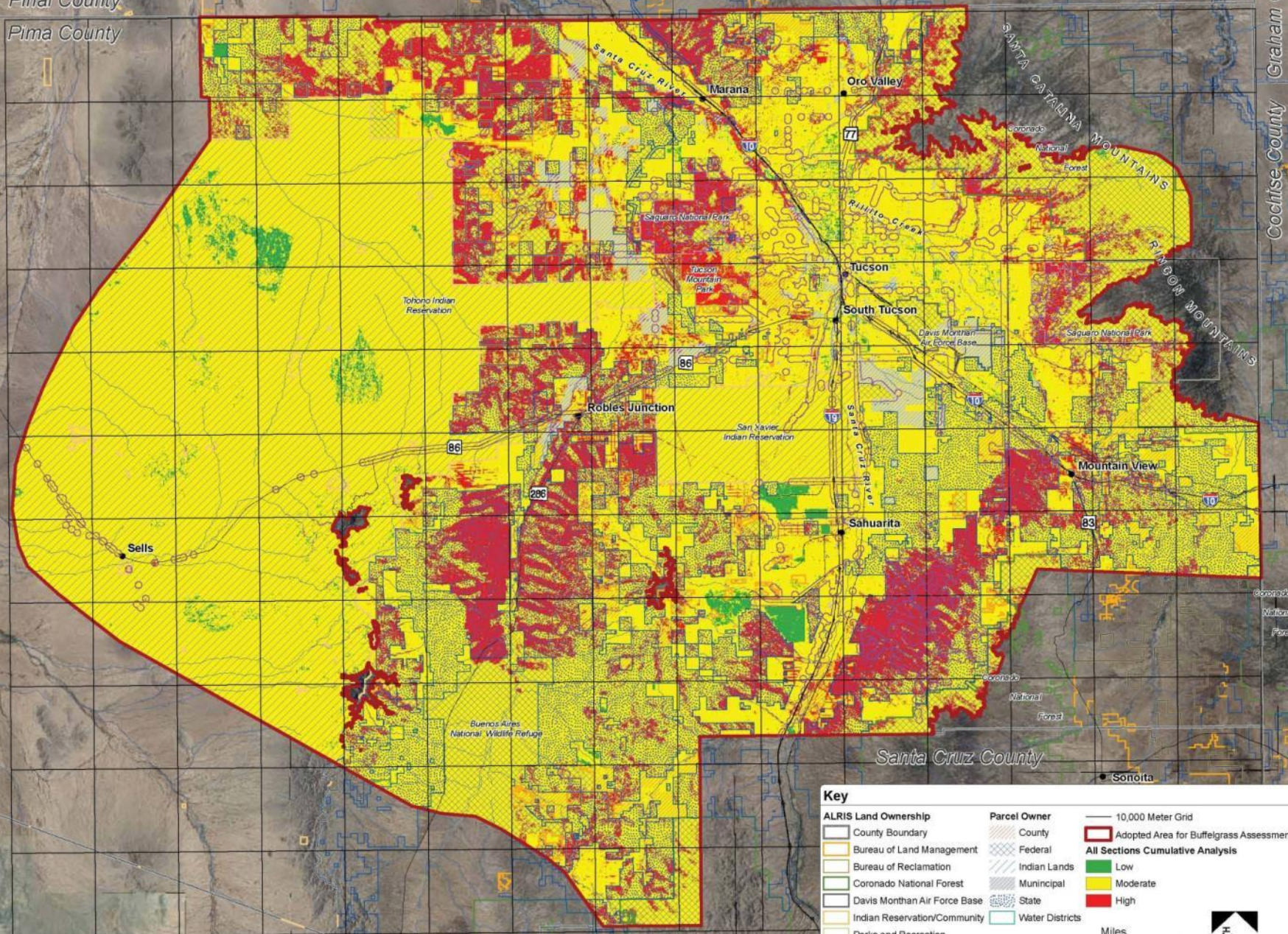


**Highest Priority**



Pinal County  
Pima County

Graham County  
Cochise County



**Key**

<b>ALRIS Land Ownership</b>	<b>Parcel Owner</b>	<b>10,000 Meter Grid</b>
County Boundary	County	Adopted Area for Buffelgrass Assessment
Bureau of Land Management	Federal	<b>All Sections Cumulative Analysis</b>
Bureau of Reclamation	Indian Lands	Low
Coronado National Forest	Municipal	Moderate
Davis Monahan Air Force Base	State	High
Indian Reservation/Community	Water Districts	
Parks and Recreation		
Saguaro National Park		
State Trust Land		

Miles  
0 10

NORTH

# Regional Mapping

Goal: Develop central data repository for the participating buffelgrass mitigation partners for the purpose of:

- Documenting the scope of the infestation
- Coordination of partners efforts across boundaries
- Regional long term planning
- Developing Decision Support Systems
- Securing funding for mitigation efforts
- Assessing the efficacy of our efforts



**iMapInvasives**  
Sharing information  
for strategic management

[Instructions](#)
[Generate Reports](#)
[Data Entry](#)
[Links](#)

[Home](#)

« buffelgrass

Go

## Invasive Species

## Locations

### Active Query

Species: Buffelgrass

## Query Options

### Configure Query

[Clear Query](#)

### Distribution

**Legend**

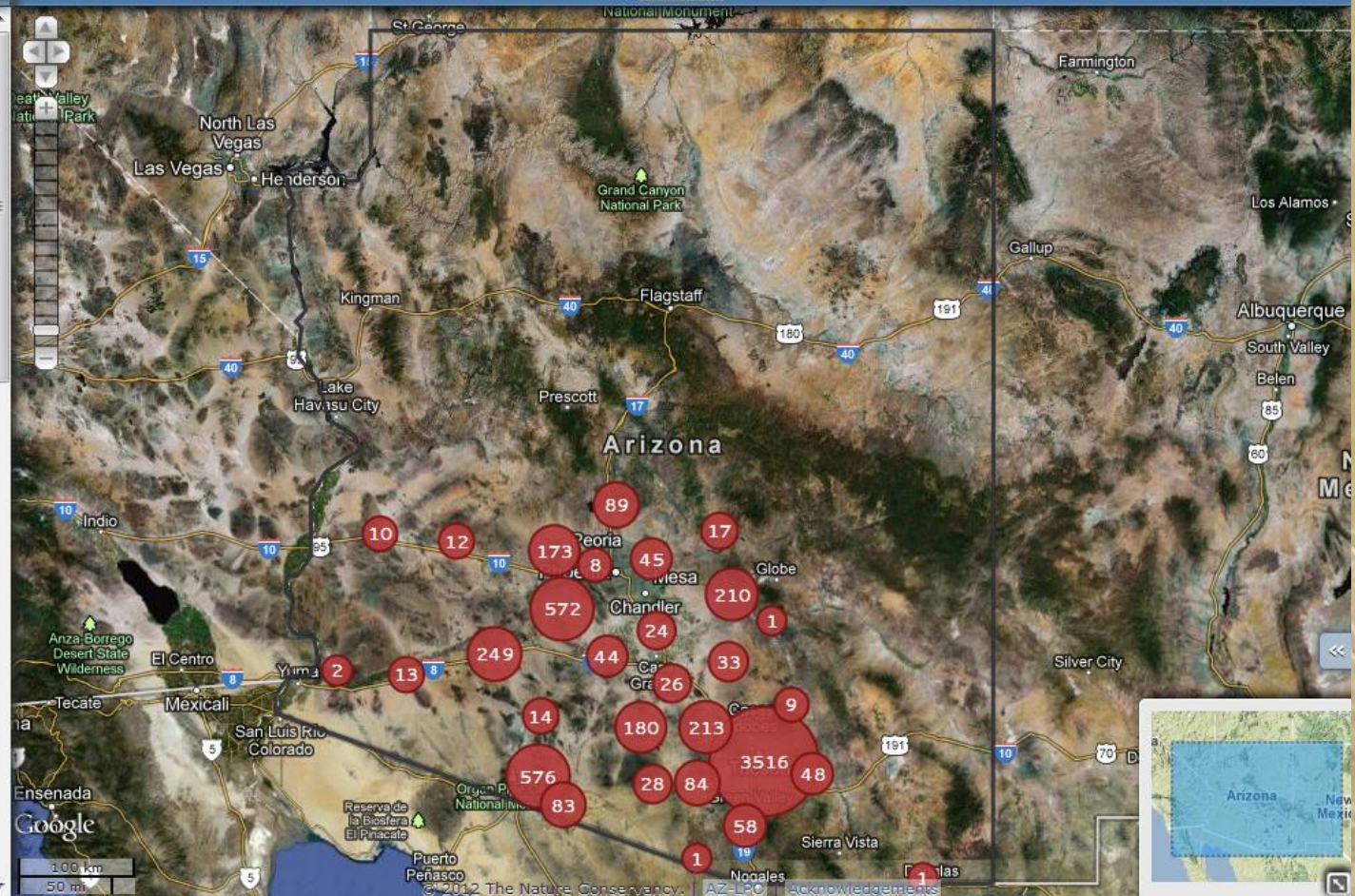
By ID

## Layers

## Base Layers

- ☐ Google Streets Layer
- ☒ Google Hybrid Layer
- ☐ Google Aerials
- ☐ Google Terrain Layer
- ☐ No Base Layer

## Overlays



# Why a DSS? (Decision Support System)

- Resources are limited
- Alternative actions are expensive
- Lag time between actions and results
- How to get the highest return on investment?



\$

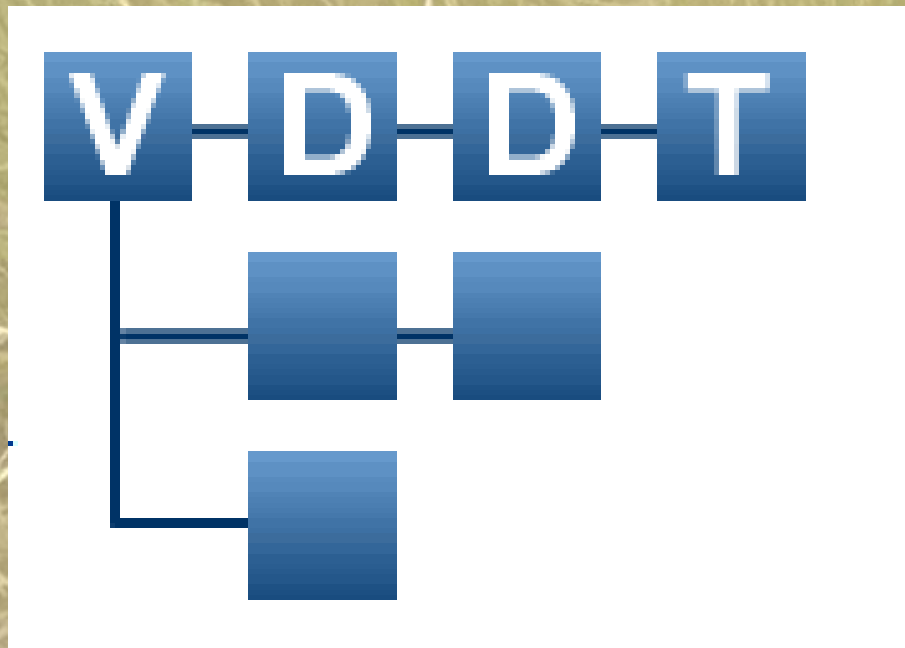


# 2012 Land Managers Meeting to develop a DSS for the IFNM



# Modelling framework

## VDDDT and TELSA



Vegetation Dynamics Development  
Tool – state and transition modeling



Tool for Exploratory Landscape  
Scenario Analysis – spatially  
explicit

# Data Needed

- Biology

- Growth habits
- Spread rate
- Habitat suitability
- Mortality
- Seed bank

Data from scientists

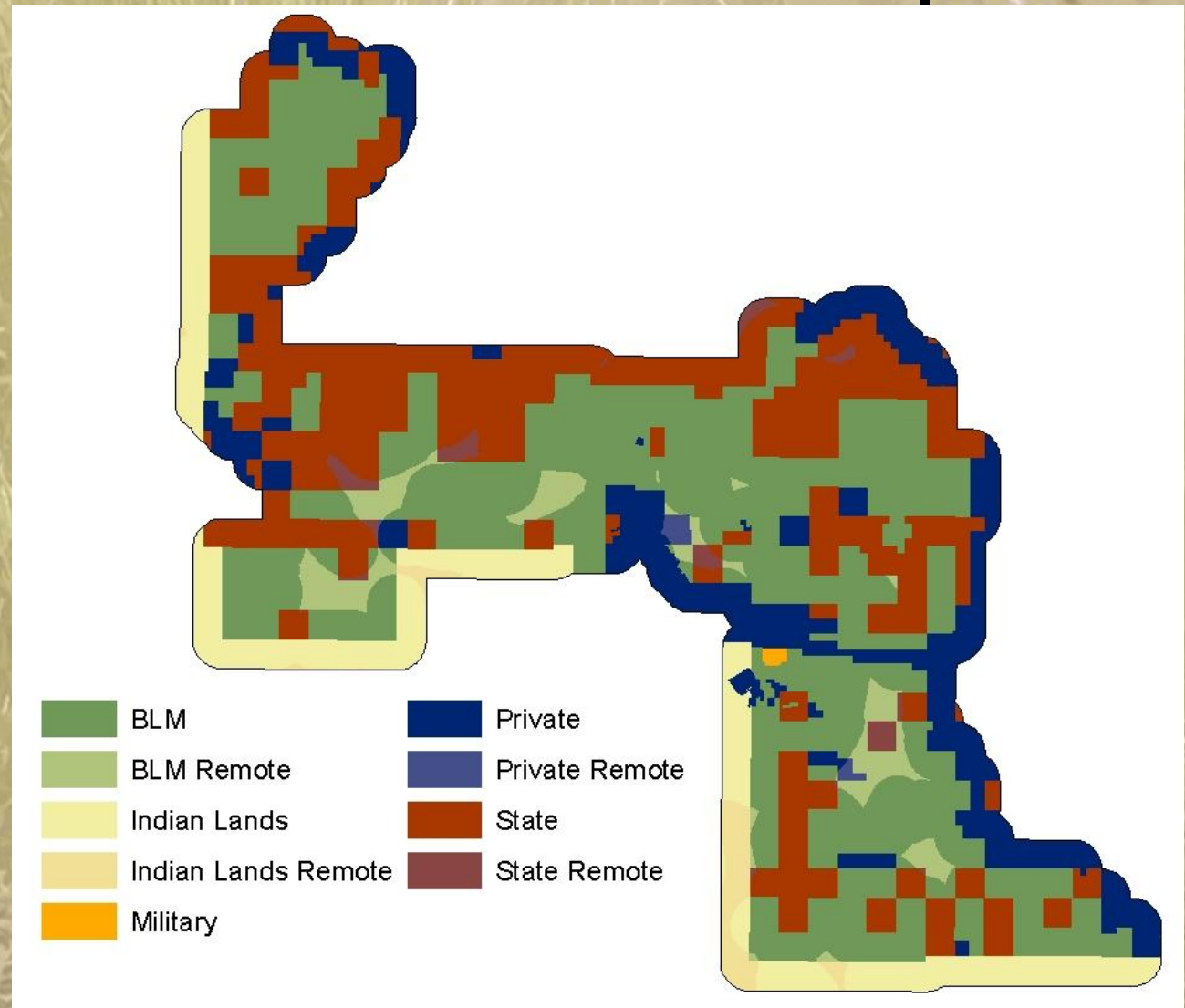
- Management Activities

- Mapping
- Treatment
- Monitoring
- Cost
- Amount
- Effectiveness

Data from landmanagers

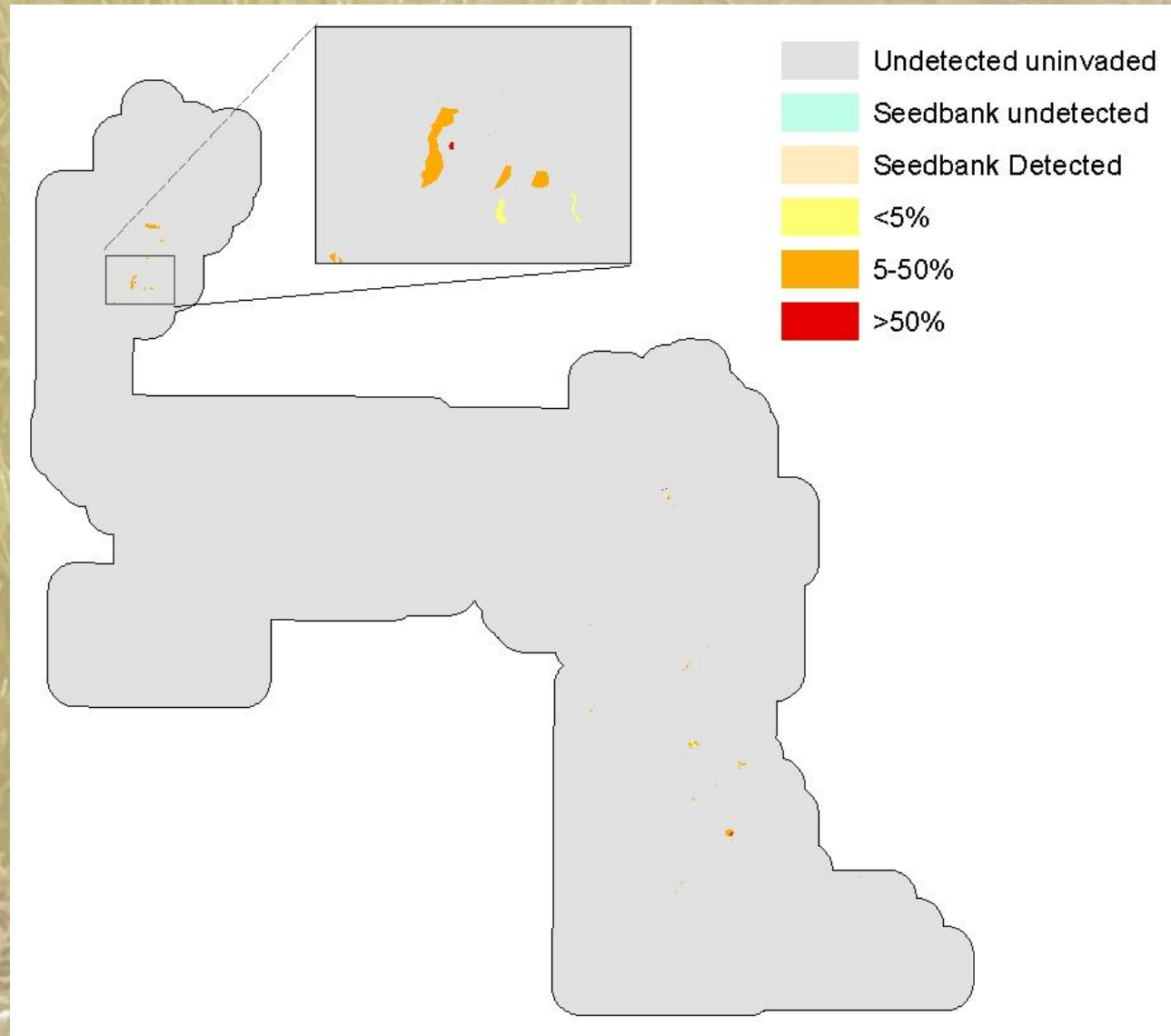
# Ironwood Land Ownership

- Remote = 1 mile from roads
- Units here define management actions



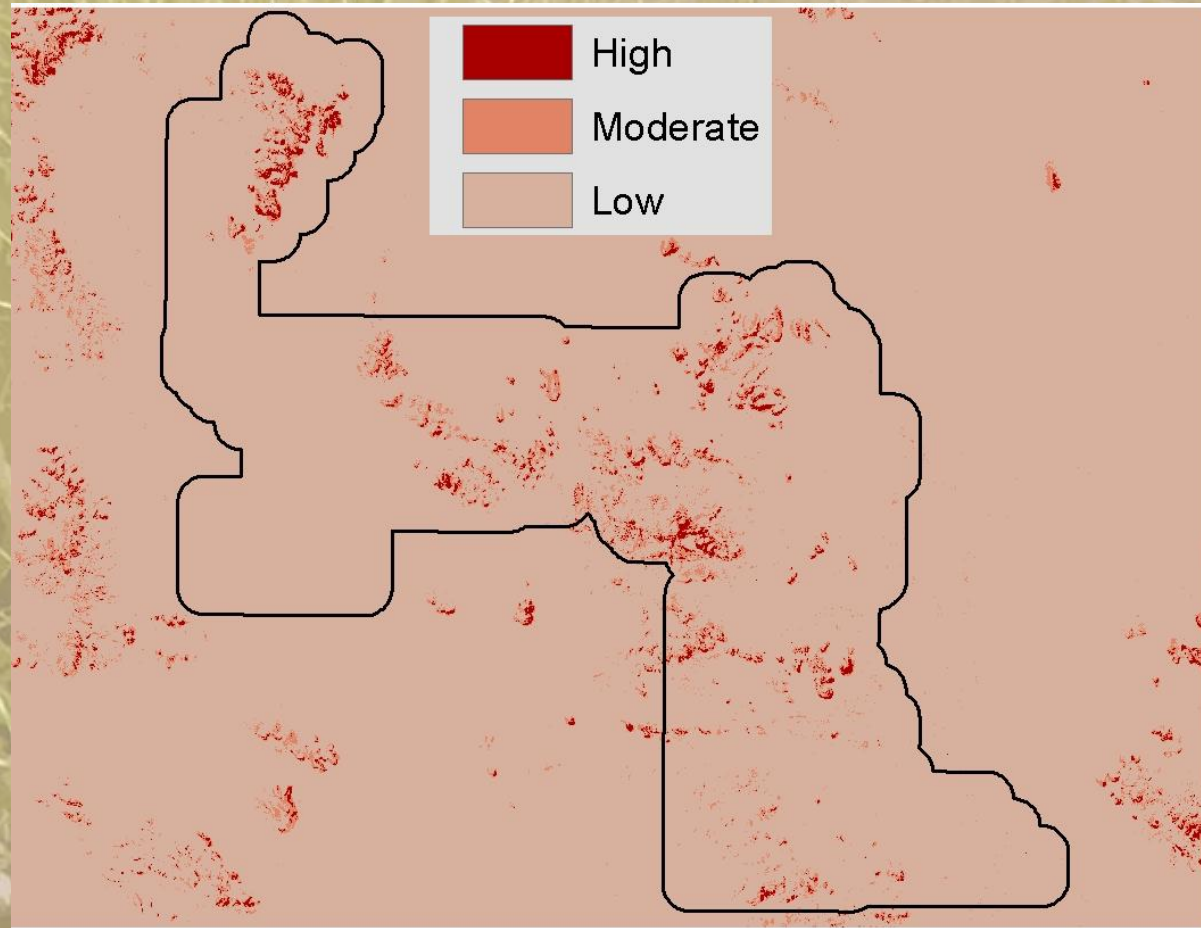
# Current Buffelgrass Invasion

- **Based on survey data by ASDM 2010**
- **Classified into categories listed**



# Habitat suitability

- Classifies landscape into three categories
- Used to change max density, probability of establishment and spread



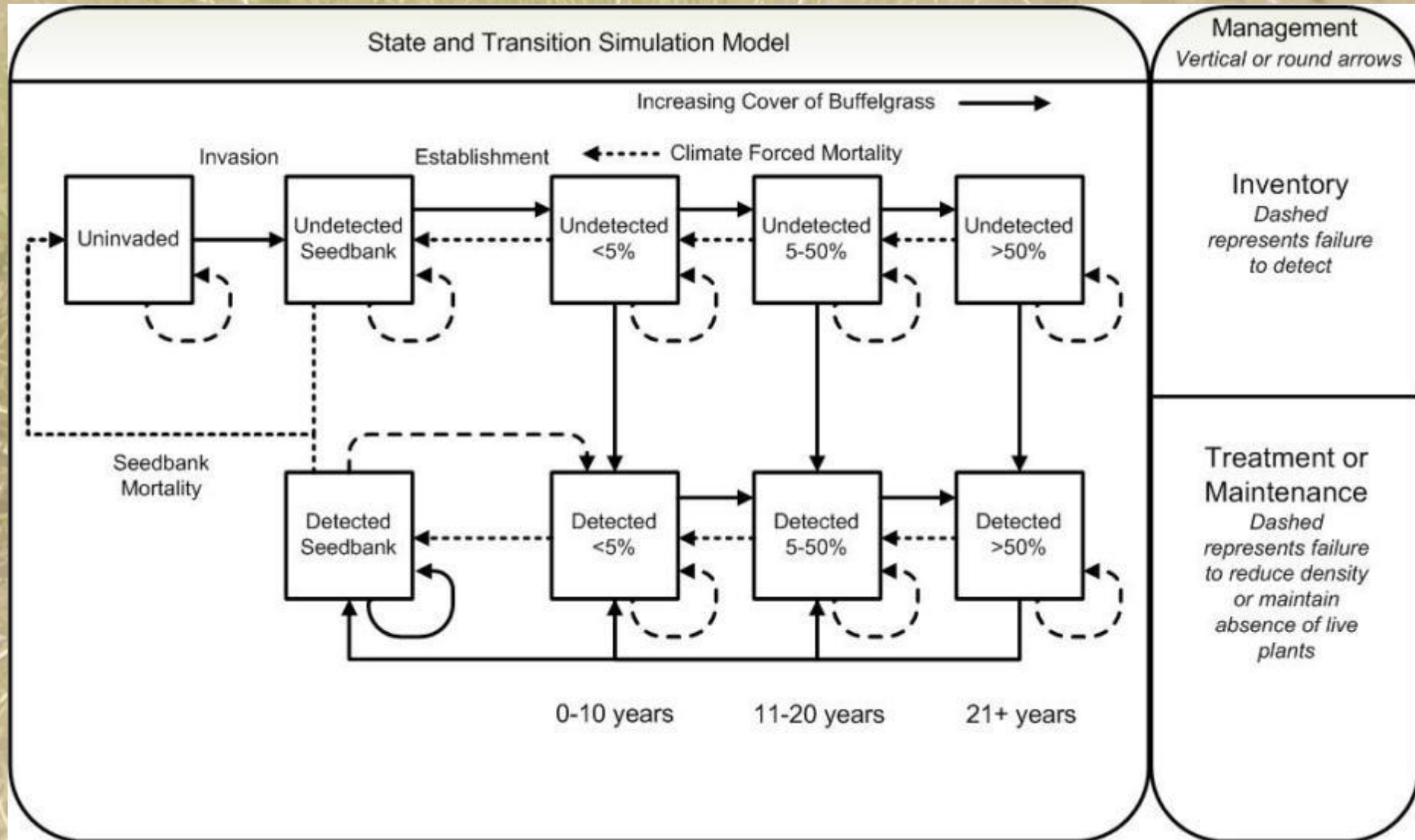
Effectiveness by percent cover

# Management Inputs

Management Activity	<5%	5 to 50%	>50%	>50 partial	Cost Per Acre	Acres Per Yr
Incidental Inventory	1%	50%	90%		\$0.06	12,000
Intensive Field Surveys	90%	90%	100%		\$0.10	129,000
Vehicle Mounted Spraying	50%*	50%*	50%*	25%	\$400.00	10
Backpack Spraying (accessible)	50%	50%*	50%	25%*	\$125.00	200
Volunteer Hand Pulling (accessible & remote)	90%	90%	90%	9%	\$68.64	40
Follow-up maintenance (volunteer remote)	100%	NA	NA		\$68.64	10
Follow-up maintenance (accessible)	100%	NA	NA		\$112.00	80

\*Have updated values not yet incorporated

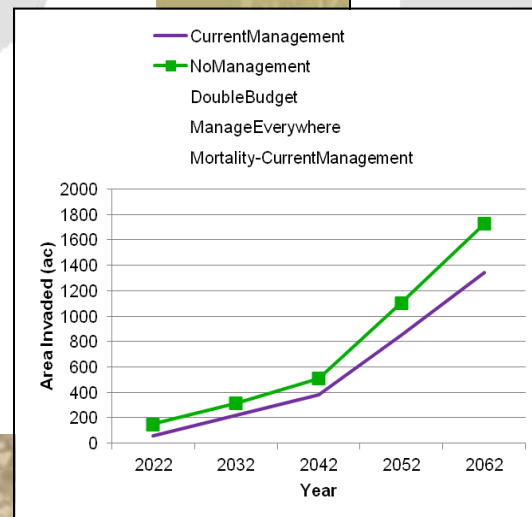
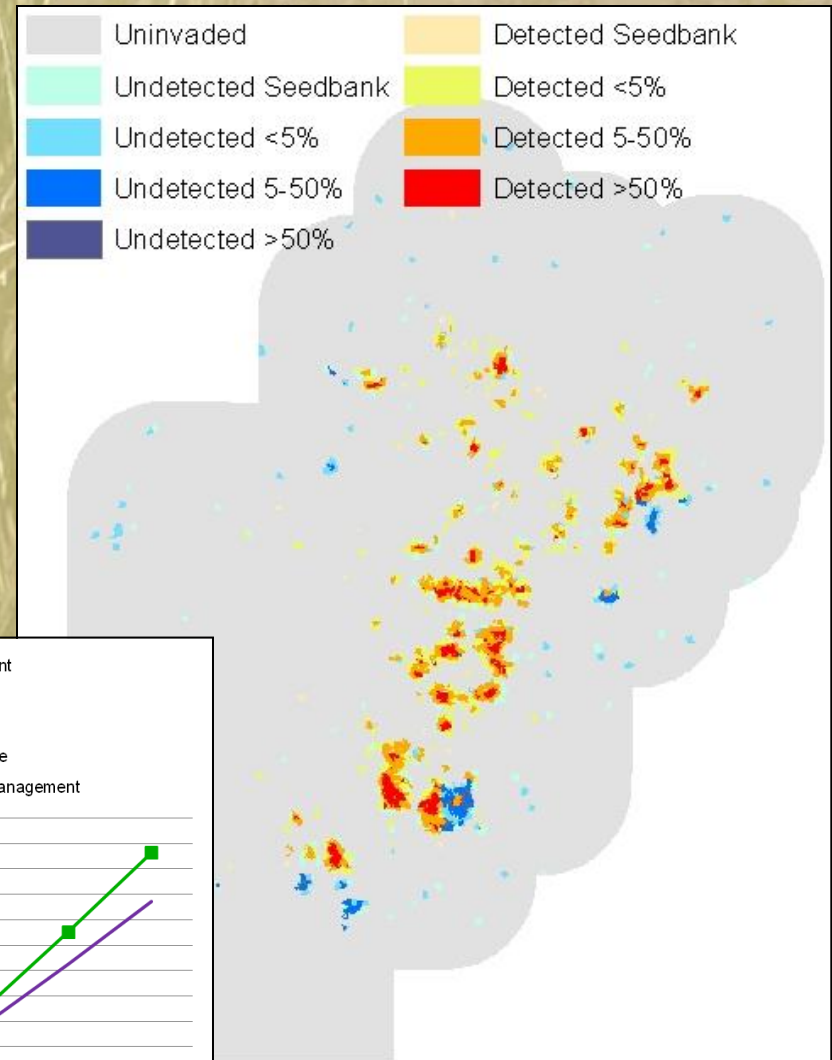
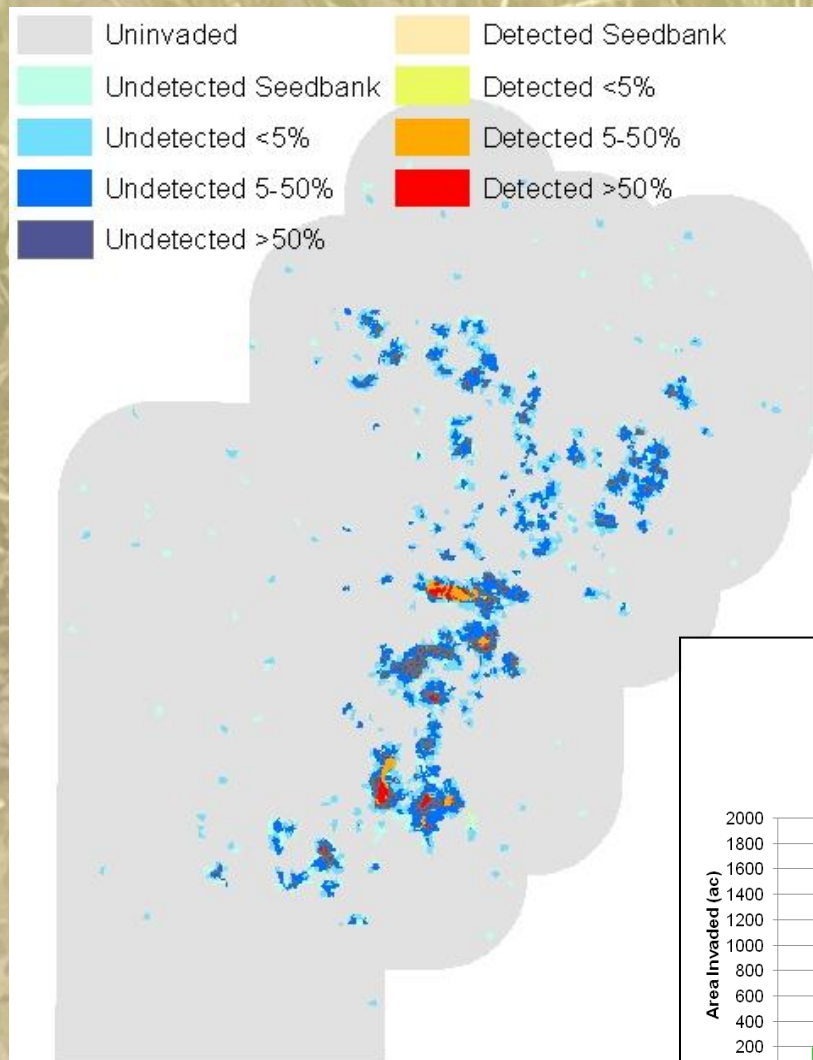
# State and Transition Model



# Scenarios run

- No Management
- Current Management
- Double Budget
  - Manager allocated
- Manage everywhere

# No Management vs Current



# Questions that can be asked

- What if control could happen in neighboring areas?
- What if intensive surveys could be conducted more frequently?
- What if budget could be increased?
- What if treatment effectiveness could be increased? What would the cost be?
- How much buffelgrass is invading from neighboring lands?
- What if volunteers were not available?
- What if budgets were interrupted so treatment would only happen every two years?
- Where is the biggest fire risk?
- Where would the most effective treatment to reduce fire risk?

# What you can do as a citizen

- Educate yourself on the issues
- Involve your neighbors
  - Make sure your HOA is working on the issue
  - Get your neighborhood association involved
- Make sure your elected officials know this is a concern that needs attention and resources
- Volunteer for a weedwacking group
- Like us on FACEBOOK
- Sign up for our Newsletter
- DONATE

[www.buffelgrass.org](http://www.buffelgrass.org)

# What you can do as a scientist

## Research Needs

- Mechanism of invasion, competition and spread
  - Level and type of disturbance that encourages spread?
  - What are the thresholds?
- Spread and niche models for different strains of buffelgrass that take into account landscape structure, pathways of dispersal, and climate variability and change (Strategic Plan)
- Ecological, physical or genetic processes that contribute to plant invasiveness
- Impacts of buffelgrass on native plant communities
  - How and to what extent is buffelgrass affecting specific species; some work on columnar cacti (Morales-Romero), palo verdes (Elits – Huxman lab), cottontop (Jason Stevens)
  - What species are in direct competition and what resources are they competing for and to what degree? (rate, depth and quantity of water uptake)
  - Growth rates of saguaros and other key flora at different buffelgrass densities.
  - EX. Introduce buffelgrass into an area and see what gets displaced, stressed, changes in nutrient and water availability, changes in wildlife use....
- What are the changes in community structure (light, height, density, etc.) and composition (richness, diversity) and what are the implications
  - Investigate relationship between buffelgrass (different strains) traits and the abiotic and physical environment to determine range limits and community composition
- Use of buffelgrass by native fauna (insects, small mammals, birds, herps)
  - What is the forage potential for natives, structure and composition for shelter (favorable or not), habitat implications
  - Is there a density dependent relationship?
- **Fire**
- Desert fires fueled by buffelgrass
  - What is going to happen to our ecosystem; infer some from red brome fires (Cave Creek – Tonto NF, Mother's Day- Saguaro NP)
  - What are the below ground effects
- Based on fire behavior models (under investigation by McDonald-McPherson) what #/acre, fuel spatial configuration, thresholds will carry fire
- Fire behavior and effects – of natives in buffelgrass stands
- Post buffelgrass fire implications on communities, recovery, soils, composition
- Post-buffelgrass fire restoration (BAER)
- Does fire kill the seed? Bury seeds at different depths.
- Fuel loads at different densities and stages of decomposition
- **Climate Change**
- Buffelgrass response (establishment, persistence, spread, etc.) to climate change
  - change in precipitation and temperature regimes,
  - CO<sub>2</sub>, GH gases, inc/dec levels of N, K, Phosphorus
- **Soils**
- Are certain microbes in soil favoring the establishment and/or persistence of non-natives
- Investigate relationship of soil nutrients, soil microbes, and buffelgrass
- Changes in soil properties due to buffelgrass infestations
- Is there an association of buffelgrass or other non-natives with N-fixators?
- Impacts on biological crusts
- **Seeds**
- At what point are the seeds viable
- How drought tolerant are the seeds
- How long can seeds persist in the soil and still be viable? Can seeds be dated
- How large (mass) is the seed bank under buffelgrass stands of different ages
- **Control**
- Herbicide efficacy trials
  - Investigate other herbicides or combinations of herbicides and adjuvants that would extend the window of treatment on buffelgrass
- Phenological models (Strategic Plan)
- Is there a relationship between age of infestation, density,...that influences number of treatments to exhaust seed bank
- Biological controls
- Decomposition of grass sprayed vs pulled vs senescent
- **Restoration**
- To what extent do treated buffelgrass patches need restoration. (Strategic Plan)
  - What are the thresholds or indicators that more active restoration is necessary
  - What methods and techniques are effective
- **Mapping and Monitoring**
- Effective techniques for mapping buffelgrass at landscape scale
  - Investigate different new imagery for detection (build on Olsson's findings)
  - Helicopter mapping (digital sketch mapping) and ground truthing methods
- Map at higher elevations
- **Economic**
- Economic impacts of buffelgrass
  - How much does Sonoran Desert contribute to the economy and what are the potential and real changes that buffelgrass can have on economics

# Research Needs

## [www.buffelgrass.org](http://www.buffelgrass.org)

- **Biodiversity and Ecosystems**
- **Fire**
- **Climate Change**
- **Soils**
- **Seeds**
- **Control**
- **Restoration**
- **Mapping and Monitoring**
- **Economic**

# Questions? / Answers?

